# *Curriculum Vitae*
# Stephen E. Haynesworth

## Personal


**Born:** September 15, 1958, Cleveland Ohio (USA)
**Married:** Theresa A. Haynesworth
**Children:** Jared, Austin and Cameron
**Home Address:** 20962 Halworth Road
**Home Phone:** (216) 751-2130; Office Phone: (216) 368-2740; Lab Phone: (216) 368-3112
**Fax:** (216) 368-4672
**E-mail:** stephen.haynesworth@case.edu


## Education

**1981-1987** **Ph.D.** Biology, Case Western Reserve University, Cleveland, Ohio 44106.

**1980-1982** **M.A.** Education, Allegheny College, Meadville, Pennsylvania 16335.

**1976-1980** **B.S.** Biology, Allegheny College, Meadville, Pennsylvania 16335.

## Professional Experience

**2003-Present** **Acting Chair, Department of Communication Sciences,** Case Western Reserve University, Cleveland, Ohio 44106.

**2003 (May – June)** **Interim Chair, Department of Psychology,** Case Western Reserve University, Cleveland, Ohio 44106.

**2002-Present** **Associate Dean, College of Arts & Sciences,** Case Western Reserve University, Cleveland, Ohio 44106.

**2002-Present** **Associate Professor of General Medical Sciences (Oncology),** Case Western Reserve University, Ireland Cancer Research Center, Cleveland, Ohio 44106. (Secondary Appointment).

**1997-Present** **Associate Professor of Biology,** Department of Biology, Case Western Reserve University, Cleveland, Ohio 44106.

**1995-2002** **Assistant Professor of General Medical Sciences (Oncology),** Case Western Reserve University, Ireland Cancer Research Center, Cleveland, Ohio 44106. (Secondary Appointment).

**1989-Present** **Assistant Professor of Orthopaedics,** Department of Orthopaedic Surgery, Case Western Reserve University School of Medicine, Cleveland, Ohio 44106. (Secondary Appointment).

**1993-1997** **Consultant**, Osiris Therapeutics, Inc., Baltimore, Maryland.

| | |
|---|---|
| **1992-1997** | **Assistant Professor of Biology,** Department of Biology, Case Western Reserve University, Cleveland, Ohio 44106. |
| **1994-1996** | **Director**, Board of Directors, Osiris Therapeutics, Inc. Baltimore, Maryland. |
| **1993** | **Co-Founder, Osiris Therapeutics, Inc.** Baltimore, Maryland. |
| **1988-1992** | **Senior Research Associate**, Department of Biology, Case Western Reserve University, Cleveland, Ohio 44106. |
| **1987-1988** | **Postdoctoral Fellow,** Medical Research Division, American Cyanamid Company, Ramapo College of New Jersey, Mahwah, NJ 07430. |
| **1983** | **Instructor,** Summer Science Program, Allegheny College, Meadville, PA 16335. |
| **1982-1987** | **Cystic Fibrosis Predoctoral Fellow**, Department of Pediatrics, Rainbow Babies & Childrens Hospital, University Hospitals of Cleveland, Cleveland, Ohio 44106. |
| **1981-1987** | **Teaching Assistant**, Department of Biology, Case Western University, Cleveland, Ohio 44106. |
| **1980-1981** | **Teacher,** High School Biology, Shaw High School, East Cleveland, Ohio 44112. |
| **1980** | **Student Teacher,** High School Biology, Cleveland Heights High School, Cleveland Heights, Ohio 44118. |
| **1978-1980** | **Director,** Tutorial Services, Allegheny College, Meadville, PA 16335. |

## Honors

| | |
|---|---|
| **2003** | **Mortar Board National Honor Society "Top Prof Award"** |
| **2003** | **Bruce Jackson M.D. Nominee for Undergraduate Advising Excellence** |
| **2002** | **Carl F. Wittke Award Nominee for Undergraduate Teaching Excellence** |
| **1999** | **Mortar Board National Honor Society "Top Prof Award"** |
| **1999** | **Carl F. Wittke Award Nominee for Undergraduate Teaching Excellence** |

| | |
|---|---|
| **1998** | **Mortar Board National Honor Society "Top Prof Award"** |
| **1998** | **Carl F. Wittke Award Nominee for Undergraduate Teaching Excellence** |
| **1995** | **Carl F. Wittke Award Nominee for Undergraduate Teaching Excellence** |
| **1995** | **T. Keith Glennan Fellowship Award Recipient**; an award to pre-tenured faculty members at Case Western Reserve University who have made outstanding starts towards balanced academic careers as "teacher-scholars." |
| **1983-1986** | **Cystic Fibrosis Predoctoral Fellowship Recipient** |

## Memberships in Professional and Scientific Societies:

**1995-1998 and 2000-2004** The American Society of Bone and Mineral Research

## Publications

**Haynesworth, S.E.**, Carrino, D.A. and Caplan, A.I. (1987). Characterization of the Core Protein of the Large Chondroitin Sulfate Proteoglycan Synthesized by Chondrocytes in Chick Limb Bud Cell Cultures, *J. Biol. Chem. 262, 22*:10574-10581.

Nakahara, H., Bruder, S.P., **Haynesworth, S.E.**, Holecek, J.J., Baber, M.A., Goldberg, V.M. And Caplan, A.I. (1990). Bone and Cartilage Formation in Diffusion Chambers by Subcultured Cells Derived From the Periosteum, *Bone 11*: 181-189.

**Hayneworth, S.E.**, Carrino, D.A. and Caplan, A.I. (1991). Comparison of the Cartilage Proteoglycan Core Protein Synthesized by Chondrocytes of Different Ages. *Conn. Tiss. Res. 25*: 311-320.

Nakahara, H., Dennis, J.E., Bruder, S.P., **Haynesworth, S.E.**, Lennon, D.P. and Caplan, A.I. (1991). In Vitro Differentiation of Bone and Hypertrophic Cartilage From Periosteal-Derived Cells. *Exp. Cell Res. 195*: 492-503.

Caplan, Goto, T., Wakitani, S., Pineda, S.J., **Haynesworth, S.E**. and Goldberg, V.M. (1991). Cell-Based Technologies for Cartilage Repair. In: *Knee Joint Instability, American Association for Orthopaedic Surgeons Symposium Proceedings*, Scottsdale Arizona.

**Haynesworth, S.E.**, Baber, M.A. and Caplan, A.I. (1992). Cell Surface Antigens on Human Marrow-Derived Mesenchymal Cells are Detected by Monoclonal Antibodies. *Bone 13*: 69-80.

**Haynesworth, S.E.**, Goshima, J., Goldberg, V.M. and Caplan, A.I. (1992). Characterization of Cells With Osteogenic Potential from Human Marrow. *Bone 13*: 81-88.

Dennis, J.E., **Haynesworth, S.E.**, Young, R.G. and Caplan, A.I. (1993) Osteogenesis in Marrow-Derived Mesenchymal Cell Porous Ceramic Composites Transplanted Subcutaneously: Effect of Fibronectin and Laminin on the Cell Retention and Rate of Osteogenic Expression. *Cell Transpl. 1*: 23-32.

Caplan, A.I., Fink, D.J., Goto, T., Linton, A.E., Young, R.G., Wakitani, S., Goldberg, V.M. and **Haynesworth S.E**. (1993). Mesenchymal Stem Cells and Tissue Repair. In: *The Anterior Cruciate Ligament: Current and Future Concepts*., Eds., D. Jackson, S. Arnocsky, S.Woo and C. Frank. New York: Raven Press, pp. 405-417.

**Haynesworth, S.E.** Goldberg, V.M. and Caplan, A.I. (1993). Diminution of the Number of Mesenchymal Stem Cells as a Cause for Skeletal Aging. In: *Musculoskeletal Soft-Tissue Aging: Impact on Mobility, Section 1, Chapter 7*, Eds. Buckwalter, J.A., Goldberg, V.M. and Woo, S.L-Y. AAOS/NIH Workshop on Aging-Related Changes in the Musculoskeletal Soft Tissue, November 19, 1992, Colorado Springs, Colorado, pp. 80-86.

Carrino, D.A., Dennis, J.E., Drushel, R.F., **Haynesworth, S.E.**, and Caplan, A.I. (1993). Identity of the Core Proteins of the Large Chondroitin Sulfate Proteoglycans Synthesized by Skeletal Muscle and Prechondrogenic Mesenchyme. *Biochem. J. 298*: 51-60.

Lennon, D.P., **Haynesworth, S.E**., Young, R.G., Dennis, J.E. and Caplan, A.I. (1995). A Chemically Defined Medium Supports in Vitro Proliferation and Maintains Osteochondrogenic Potential of Rat Marrow-Derived Mesenchymal Stem Cells. *Exp. Cell Res. 219*: 211-222.

Lazarus, H., **Haynesworth, S.E.**, Rosenthal N., Gerson, S., Caplan, A.I. (1995). Ex Vivo Expansion and Subsequent Infusion of Human Bone Marrow-Derived Stromal Progenitor Cells (Mesenchymal Stem Cells)[MSCs]: Implications for Therapeutic Use. *Bone Marrow Transplant. 16*, 557-564.

**Haynesworth, S.E.**, Baber, M.A. and Caplan, A.I. (1996). Cytokine Expression by Human Marrow-Derived Mesenchymal Progenitor Cells In Vitro: Effects of Dexamethasone and IL-1$\alpha$. *J. Cell. Physiol. 166*, 585-592.

Lennon, D.P., **Haynesworth, S.E.**, Bruder, S.P., Jaiswal, N. and Caplan, A.I. (1996). Human and Animal Mesenchymal Progenitor Cells from Bone Marrow: Identification of Serum for Optimal Selection and Proliferation. *In Vitro 32*, 602-611.

Jaiswal, N., **Haynesworth, S.E.**, Caplan, A.I. and Bruder, S.P. (1997). Osteogenic Differentiation of Purified, Culture-Expanded Human Mesenchymal Stem Cells In Vitro. *J. Cell. Biochem. 64,* 295-312.

Bruder, S.P., Jaiswal, N. and **Haynesworth, S.E.** (1997). Growth Kinetics, Self-Renewal and the Osteogenic Potential of Purified Human Mesenchymal Stem Cells During Extensive Subcultivation and Following Cryopreservation. *J. Cell. Biochem. 64,* 278-294.

Bruder, S.P., Horowitz, M.C. and **Haynesworth, S.E.** (1997). Monoclonal Antibodies Selective for Human Osteogenic Cell Surface Antigens. *Bone 21*, 2, 225-235.

Lazarus, H.M., **Haynesworth, S.E.**, Gerson, S.L. and Caplan, A.I. (1997). Human Bone Marrow-Derived Mesenchymal (Stromal) Progenitor Cells (MPCs) Cannot Be Recovered from Peripheral Blood Progenitor Cell Collections. *J.Hematotherapy 6*, 447-455.

Allay, J.A., Dennis J.E., **Haynesworth, S.E.**, Majumdar, M.K., Clapp, D. W., Caplan, A.I., Gerson, S.L. (1997). LacZ and IL-3 Expression In Vivo in Retrovirally Transduced Marrow-Derived Human Osteogenic Mesenchymal Progenitors. *Human Gene Therapy, 8,* 1417-1427.

Fleming, J.E., **Haynesworth, S.E.,** Cassiede, P.**,** Baber, M.A., and Caplan, A.I. (1998). A Monoclonal Anitibody Against Adult Marrow-Derived Mesenchymal Stem Cells Recognizes Developing Vascular in Embryonic Human Skin. *Developmental Dynamics 212,* 119-132.

**Haynesworth, S.E.**, Reuben, D. and Caplan, A.I. (1998). Cell-based Tissue Engineering Therapies: The Influence of Whole Body Physiology. *Adv. Drug Delivery Rev. 33,* 3-14.

Barry, F.P., Boynton, R.E., **Haynesworth, S.E.**, Murphy, J.M. and Zaia, J. (1999). The Monoclonal Antibody SH-2 Raised Against Human Mesenchymal Stem Cells, Recognizes an Epitope on Endoglin (CD105). *Biochem., Biophys.Res. Com. 265*, 134-139.

Koc, O.N., Gerson, S.L., Cooper, B. W., Dyhouse, S. M., **Haynesworth, S.E.**, Caplan, A.I. and Lazarus, H.M. (2000). Rapid Hematopoietic Recovery After Co-infusion of Autologous Blood Stem Cells and Culture-Expanded Marrow Mesenchymal Stem Cells in Advanced Breast Cancer Patients Receiving High Dose Chemotherapy. *J. Clin. Oncology 18*: 307-316

Lennon, D.P., **Haynesworth, S.E.**, Arm, D.E., Baber, M.A. and Caplan, A.I. (2000). Dilution of Human Mesenchymal Stem Cells with Dermal Fibroblasts and the Effects on In Vitro and In Vivo Osteochondrogenesis. *Developmental Dynamics 219: 50-62.*

Majumdar, M.K., Thiede, M.A., **Haynesworth, S.E.**, Bruder, S.P., and Gerson, S.L. (2000). Human Marrow-Derived Mesenchymal Stem Cells (MSCs) Express Hematopoietic Cytokines and Support Long-Term Hematopoiesis When Differentiated Toward Stromal and Osteogenic Lineages. *Journal of Hematotherapy and Stem Cell Research. 9(6)*:841-848; 2000.

Barry, F., Boynton, R., **Haynesworth, S.E.,** Murphy, M. and Zaia, J.(2001). The SH3 and SH4 Monoclonal Antibodies Recognize Distinct Epitopes on CD73 from Human Mesenchymal Stem Cells. *Biochem. Biophys. Res. Comm.* 289, 519-524.

Kadereit, S., Deeds, L.S., **Haynesworth, S. E.**, Koc, O.N., Kozik, M.M., Skekely, E., Daum-Woods, K., Goetchius, G.W., Fu, P., Welniak, L.A., Murphy, W.J., Laughlin, M.J. (2002). Expansion of LTC-IC and Maintenance of p21 and BCL-2 Expression in Cord Blood CD34+/CD38- Early Progenitors Cultured over Human MSC as a Feeder Layer. *Stem Cells*, 20 (6): 573-582.

Le Blanc, K., Tammik, L., Sundberg, B., **Haynesworth, S.E.** and Ringden (2003). Mesenchymal Stem Cells Inhibit and Stimulate Mixed Lymphocyte Cultures and Mitogenic Responses Independently of the Major Histocompatibility Complex. *Scandinavian J Immunology*. 57, 11-20.

Maitra, B., Szekely, E., Laughlin, M.J., Dennis, J. S.E., **Haynesworth, S. E.** and Koc, O.N. (2004). Human Mesenchymal Stem Cells Support Unrelated Donor Hematopoietic Stem Cells and Suppress T-Cell Activation. Bone Marrow Transplantation 33, 597-604.

MacKay, D., Tesar, P.J., Liang, Li-Nuo and **Haynesworth, S.E.** (2006). Characterizing oMedullary and Human Mesenchymal Stem Cell-Derived Adipocytes. J. Cellular Physiology, 207, 722-728.

**Haynesworth, S.E.,** Kadiyala, S., Liang, L. and Bruder, S.P. (2006). Platelet-Rich Plasma Stimulates Chemotaxis, Mitogenesis, and Maintains Osteogenic Potential of Human Mesenchymal Stem Cells. In Revision.

Youssef, J.A, Brodke, D.S., Wang, J.C., Lieberman, I.H, Lauryssen, C., Haynesworth, S.E., Muschler, G.F. (2006). A Prospective, Multi-Center Study of Selective Osteoprogenitor Cell Retention for Enhancement of Lumbar Spinal Fusion: A Preliminary Report. In Preparation.

## Abstracts

**Haynesworth, S.E.** and Caplan, A.I. (1986). The Gordon Conference on Proteoglycans.

Carrino, D.A., **Haynesworth, S.E.**, Drushel, R.F. and Caplan, A.I. (1987). Society for Complex Carbohydrates Annual Meeting.

Carrino, D.A., Drushel, R.F., **Haynesworth, S.E**., Pechak, D.G. and Caplan, A.I. (1988). Department of Biology Centennial Celebration, Case Western Reserve University, Cleveland, Ohio.

Caplan, A.I., Lucas, P.A., Nakahara, H. and **Hayneworth, S.E.** (1988). Molecular Control of Chemotactic Migration of Mesenchymal Stem Cells. Third International Conference on the Chemistry and Biology of Mineralized Tissue, Abstract #18.

**Haynesworth, S.E.**, Holecek, J.J., and Caplan, A.I. (1989). Purification of a Chondro-osteoinductive Factor From Demineralized Bone. Transactions of the 35th Annual Meeting, Orthopaedic Research Society 14, 1977.

Carrino, D.A., Dennis, J.E., Drushel, R.F., **Haynesworth, S.E.**, Schwartz, N.S. and Caplan, A.I. (1989). Electrophoretic and Electron Microscopic Analysis of Chick Cartilage Proteoglycan Core Protein. Transactions of the 35th Annual Meeting, Orthopaedic Research Society 14, 10: **Haynesworth, S.E.**, Holecek, J.J. and Caplan , A.I. (1989). Purification of a Chemotactic Factor From Bovine Bone for Mesenchymal Cells. Transactions of the 36th Annual Meeting, Orthopaedic Research Society 15, 2: 385.

Nakahara, H. Bruder, S.P., **Haynesworth, S.E**. Goldberg, V.M. and Caplan, A.I. (1990). High Cell Density as a Test for Osteochondrogenic Potential of Periosteal-Derived Cells. Orthopaedic Transactions, JBJS.

**Haynesworth, S.E.**, Baber, M.A. and Caplan, A.I. (1991). Cell Surface Antigens on Human Marrow-Derived Mesenchymal Cells are Detected by Monoclonal Antibodies. Transactions of the 37th Annual Meeting, Orthopaedic Research Society 16, 1: 169 .

**Haynesworth, S.E.,** Goshima, J., Goldberg, V.M. and Caplan, A.I. (1991). Isolation and Expansion of Cells with Osteogenic Potential from Human Marrow. Transactions of the 37th Annual Meeting, Orthopaedic Research Society 16, 2: 416.

**Haynesworth, S.E.**, Young, R.G. and Caplan, A.I. (1992). Comparison of the Osteogenic Potential of Marrow-Derived Mesenchymal Cells from Young and Old Donors. Transactions of the 38th Annual Meeting, Orthopaedics Research Society, 17, 2: 600.

Lazarus, H.L., **Haynesworth, S.E.**, Gerson, S.L. and Caplan, A.I. (1992). Marrow-Derived Stromal Progenitors [Mesenchymal Stem Cells]: Phase I Clinical Trial. Blood 80: 236a.

Allay, J.A., Dennis, J.E., **Haynesworth, S.E.**, Clapp, D.W., Lazarus, H.M., Caplan, A.I. and Gerson, S.L. (1994). Retroviral Transductions of Marrow-Derived Mesenchymal Precursors. Blood 82, 1: 477A.

**Haynesworth, S.E.**, Baber, B.A. and Caplan, A.I. (1995). Characterization of the Unique Mesenchymal Stem Cell Phenotype In Vitro. Transactions of the 41st Annual Meeting, Orthopaedic Research Society 20, 1: 7.

Bruder, S. P., Lawrence, E.G. and **Haynesworth, S.E.** (1995). The Generation of Monoclonal Antibodies Against Human Osteogenic Cells Reveals Embryonic Bone Formation In Vivo and Differentiation of Purified Mesenchymal Stem Cells In Vitro. Transactions of the 41st Annual Meeting, Orthopaedic Research Society 20, 1: 8.

Bruder, S.P., Eames, B.F. and **Haynesworth, S.E.** (1995). Osteogenic Induction of Purified Human Mesenchymal Stem Cells In Vitro: Quantitative Assessment of the Osteoblastic Phenotype. Transactions of the 41st Annual Meeting, Orthopaedic Research Society 20, 2: 464.

Reuben, D.Y., **Haynesworth, S.E.**, Young, R.G. and Caplan, A.I. (1995). Distribution of Mesenchymal Stem Cells with Age. The Irwin H. Lepow Student Research Day, Case Western Reserve University School of Medicine.

Lazarus, H.M., **Haynesworth, S.E.**, Gerson, S.L., Rosenthal, N.S. and Caplan, A.I. (1995). Ex Vivo Expansion & Subsequent Infusion of Human Bone Marrow (BM)-Derived Stromal Progenitors (Mesenchymal Stem Cells)[MSCs]: Implication for Therapeutic Use: Keystone Conference on Bone Marrow Transplantation, Keystone Colorado, January 26-28, 1995.

Bruder, S.P., Lawrence, E.G. and **Haynesworth, S.E.** (1995). Identification and Characterization of Human Osteogenic Cell Surface Differentiation Antigens. Seventeenth Annual Meeting of the American Society for Bone and Mineral Research 10, 1, 249T.

Majumdar, M.P., **Haynesworth, S.E.**, Theide, M.A., Marshak, D.R., Caplan, A.I. and Gerson, S.L. (1995). Culture-Expanded Human Mesenchymal Stem Cells (MSCs) Express Cytokines and Support Hematopoiesis In Vitro. Blood 86, 494A.

Bruder, S.P., Jaiswal, N. and **Haynesworth, S.E.** (1996). Growth Kinetics, Self-Renewal, and The Ostengenic Potential of Human Mesenchymal Stem Cells During Extensive Subcultivation and Following Cryopreservation. Eighteenth Annual Meeting of the American Society for Bone and Mineral Research 11, 1, T364.

Rupp, R.W., Reddy, H. **and Haynesworth, S.E.** (1997). ß1 Integrin Expression by Human Mesenchymal Stem Cells and Their Involvement in Osteogenic Differentiation In Vitro. Transactions of the 43rd Annual Meeting, Orthopaedic Research Society 22, 1, 17.

Albakri, Q.A. and **Haynesworth, S.E.** (1997). Human Mesenchymal Stem Cell Cultures Contain Factors With Automiotgenic Activity. Nineteenth Annual Meeting of the American Society for Bone and Mineral Research 12, 1, F354.

**Haynesworth, S.** (1997). Interleukin-1 Modulates Glucocorticoid-Induced Osteogenic Differentiation and the Expression of Bone Resorptive Cytokines by Human Mesenchymal Stems. Nineteenth Annual Meeting of the American Society for Bone and Mineral Research 12, 1, 323.

Koc, O.N., Dyhouse, S.M., Gerson, S.L., **Haynesworth, S.E.**, Cooper, B.W., Kutteh, L., Caplan, A.I. and Lazarus, H.M. (1997). Culture-Expanded Autologous Human Mesenchymal Stem Cells (MSCs) Circulate in Blood and Retain Proliferative Capacity Following IV Infusion Into Breast Cancer Patients. Blood 90, Suppl. 1: 365, #1637.

Koc, O.N., Gerson, S.L., Cooper, B.W., Dyhouse, S.M., **Haynesworth, S.E.**, Caplan, A., Tainer, N. and Lazarus, H.M. (1998). Rapid Hematopoietic Recovery After Co-Infusion of Autologous Culture-Expanded Human Mesenchymal Stem Cells (hMSCs) and PBPCs in Breast Cancer Patients Receiving High Dose Chemotherapy. Blood 92, 274A .

Boynton, R.E., **Haynesworth, S.E.**, Zaia, J., Murphy, J.M., McIntosh, A. and Barry, F.P. (1998). A Transforming Growth Factor-Beta Binding Protein Expressed on the Surface of Bone Marrow-Derived Mesenchymal Stem Cells is Recognized by the Monoclonal Antibody SH-2. Transactions of the 45th Annual Meeting, Orthopaedic Research Society 24, 1, 64.

Bos, L.S., Mohammad, S.F., **Haynesworth, S.E.**, Sramkoski, R.M., Jacabberger, J., Welniak, L.A., Murphy, W.J., Koh, C.Y., Szekely, E., Junge, G.R., Kadereit, S., Miller, R.E. and Laughlin, M.J. (1999). Mesenchymal Stem Cell (MSC)-Based Umbilical Cord Blood Ex Vivo Expansion. Blood 94, 10, Suppl. 1, Part 2 , 345b.

**Haynesworth, S. E.** and Liang, L. (2000). Effects of glucocorticoid and Interleukin-1 on Nuclear Factor Kappa B Translocation and Expression during the Osteogenic Differentiation of Human Mesenchymal Stem Cells. Journal of Bone and Mineral Research, 15, Suppl. 1, S71.

Bos, L.S., Mandel, D., Kadereit, S., **Haynesworth, S.E.**, Koc, O.N., Szekely, E., Daum-Woods, K., Kulchycki, L., Jin, W., Laughlin M.J (2000). Effects of Mesenchymal Stem Cell (MSC)-Based Versus Cytokine-Based Umbilical Cord Blood (UCB) Short Term Expansion on Graft CD34 and Accessory Cell Number and Function . Blood 96, 11, 2, 4180.

Jaroscak, J., Smith, T., **Haynesworth, S.E.**, Laughlin, M.J., Kurtzberg, J., Gerson, S.L. (2000). Preliminary Characterization of the Surface Staining of Placental Derived Adherent Cells: A Potential New Source of Stroma for Umiblical Cord Blood (UCB) Expansion. Blood 96.

Kozik, M.M., Bos, L., Kadereit, S., Koc, O. N., **Haynesworth, S.E.,** Meyerson, H., Szekely, E. and Laughlin, M.J. (2001). Effects of Mesenchymal Stem Cell Stromal Layer on Umbilical Cord Blood LTC-IC and CD34 Populations During Short Term Expansion. Blood 98, 360.

Maitra, B., Dennis, J.E., Nihal, M., Laughlin, M.J., **Haynesworth, S.E.** and Koc, O.N. (2001). Human Bone Marrow Derived Mesenchymal Stem Cells (MSCs) Contain Highly Proliferative Small Cells With Tri-lineage Mesenchymal Differentiation Potential. Blood 98, 4249.

**Haynesworth, S.E.,** Kadiyala, S., Liang, L. and Bruder, S.P. (2002). Mitogenic Sttimulation of Human Mesenchymal Stem Cells By Platelet Releasate Suggests a Mechanism for Enhancement of Bone repair by Platelet Concentrate. Transactions of the 48rd Annual Meeting, Orthopaedic Research Society 27, 462.

MacKay, D., Tesar, P.J., Liang, Li-Nuo and **Haynesworth, S.E.** (2002). Expression Profile Comparison for the Characterization of Human Mesenchymal Stem Cell-Derived Adipocytes and Medullary Adipocytes. Cold Spring Harbor Laboratory Conference on Tissue Engineering, November 21-24, 2002.

MacKay, D., Tesar, P.J., Liang, Li-Nuo and **Haynesworth, S.E.** (2003). An Expression Profile Comparison of Human Mesenchymal Stem Cell-derived Adipocytes, Medullary Adipocytes and White Adipocytes. 25th Annual Meeting of the American Society of Bone and Mineral Research. Abstract #1885.

Wang, J.C., Youssef, J.A., Lieberman, I.H., Brodke, D.S., **Haynesworth, S.E.**, Lauryssen, C., Patel, T. (2003). Selective Cell Retention Technology for Spinal Fusion. International Meeting on Advanced Spine Techniques.

Whitkop, C., Bisson, B., Neill, H., Webster, S. Liang, Li-Nuo and **Haynesworth, S.E.** (2004). Harnessing the Healing Potential Through Selective Retention of Bone Marrow Aspirate. Society of Clinical Research Associates..

## Invited Lectures

*Mesenchymal Stem Cells that Differentiate into Cartilage or Bone*. Special Interest Subgroup Meeting on, "Where are the Stem Cells Needed for Tissue Engineering?" The American Society for Cell Biology 31st Annual Meeting, December 8, 1991.

*Tissue Engineering*. Keynote Address, The Howard Hughes Medical Institute-supported Campus Visitation Day for High School Students. Department of Biology, Case Western Reserve University, October, 1993.

*Effects of Stem Cells on Osteoblastic Activity*. Research Symposium on Clinical Potential for Biologically Based Osteogenic Factors. The American Academy of Implant Dentistry 43rd Annual Meeting & Frontiers in Implant Science Symposium, New Orleans, Louisiana October 9, 1994.

*Stromal and Osteogenic Potential of Marrow Mesenchymal Progenitors*. Blood Club Seminar Series, Division of Hematology/Oncology, Case Western Reserve University/Ireland Cancer Center, January 5, 1996.

*Osteogenesis by Human Mesenchymal Stem Cells In Vitro: Effects Of Glucocorticoid and Interleukin-1*. Department of Gene Therapy, Allegheny University of the Health Science. Philadelphia PA, July 15, 1997.

*Mesenchymal Stem Cells in Orthopaedics and Gene Therapy*, International Symposium on Gene Therapy and the Musculoskeletal System, Berne, Switzerland, September 1, 2000.

*Human Mesenchymal Stem Cell Plasticity*. Aastrom Biosciences, Ann Arbor, MI, October 22, 2001.

*Mitogenic and Chemotactiv Sttimulation of Human Mesenchymal Stem Cells By Platelet Releasate Suggests a Mechanism for Enhancement of Bone repair by Platelet Concentrate*. DePuy, Orthopaedics, Inc., Raynham, MA, April 6, 2002.

*Human Mesenchymal Stem Cell Plasticity*. Developmental Biology Journal Club, Case Western Reserve University, May 17, 2002.

*"Human Mesenchymal Stem Cell Biology*." Short Course in Cell-Based Therapies and Tissue Engineering, Case Western Reserve University, May 29, 2002.

*Platelet-Rich Plasma Stimulates Stem Cell Chemotaxis, Proliferation, and Potentiates Osteogenic Differentiation*. Emerging Technologies in Spinal Surgery, Washington DC, October 17-19, 2002.

*Mesenchymal Stem Cell Response to Platelet Rich Plasma and Its Growth Factors*. Second Symposium on Platelet Rich Plasma & Its Growth Factors. San Francisco, CA April 24, 2003.

*Human Mesenchymal Stem Cell Biology*. Second Annual Symposium on Cell-Based Therapies and Tissue Engineering, Case Western Reserve University, May 27, 2003.

*Platelet-Rich Plasma Stimulation of Human Mesenchymal Stem Cells*. New Advances in Biologically Based Technologies for Oral Indications. Chicago IL, July 11, 2003.

*Mesenchymal Stem Cells: Basic Science to Tissue Engineering*. Department of Biology Seminar Series, Morehouse College, Atlanta, GA, October 20, 2003.

*Human Mesenchymal Stem Cell Biology*. Second Annual Symposium on Cell-Based Therapies and Tissue Engineering, Case Western Reserve University, May 17, 2004.

## Patents

Caplan, A.I. and **Haynesworth, S.E.** (March 30, 1993). Method for Enhancing the Implantation and Differentiation of Marrow-Derived Mesenchymal Cells. Patent No. 5,197,985.

Caplan, A.I. and **Haynesworth, S.E.** (July 13, 1993). Method for Treating Connective Tissue Disorders. Patent No. 5,226,914, July 13, 1993.

Caplan, A.I. and **Haynesworth, S.E.** (January 23, 1996). Human Mesenchymal Stem Cells. Patent No.5,486,359.

Gerson, S.L., Caplan, A.I. and **Haynesworth, S.E.** (January 7, 1997). Transduced Mesenchymal Stem Cells. Patent No. 5,591,625.

Bruder, S.P., Caplan, A.I. and **Haynesworth, S.E.** (July 1, 1997). Monoclonal Antibodies for Human Osteogenic Cell Surface Antigens. Patent No. #5,643,736.

**Haynesworth, S.E.**, Caplan, A.I., Gerson, S.L., Lazarus, H.M (March 31, 1998). Enhancing Bone Marrow Engraftment Using MSCs. Patent No. 5,733,542.

Bruder, S.P., Caplan, A.I. and **Haynesworth, S.E.** (April 7, 1998). Lineage-Directed Induction of Human Mesenchymal Stem Cell. Patent No. 5,736,396.

Caplan, A.I. and **Haynesworth, S.E.** (September 22, 1998). Connective Tissue Regeneration Using Human Mesenchymal Stem Cell Preparations. Patent No. 5,811,094

Caplan, A.I., **Haynesworth, S.E.** (November 17, 1998). Monoclonal Antibodies for Human Mesenchymal Stem Cells. Patent No. 5,837,539.

Caplan, A.I., Bruder, S.P., and **Haynesworth, S.E.** (August 24, 1999). Lineage-Directed Induction of Human Mesenchymal Stem Cell. Patent No. 5,942,225

Caplan, A.I., **Haynesworth, S.E.** and Gerson, S.L. and Lazarus, H,M, (January 4, 2000). "Enhancing Hematopoietic Progenitor Cell Engraftment Using Mesenchymal Stem Cells. Patent No. 6,010,696.

Caplan, A.I., **Haynesworth, S.E.** (July 11, 2000). Monoclonal Antibodies for Human Mesenchymal Stem Cells. Patent No. 6,087,113.

## Reviewer

Journal of Bone and Joint Surgery
Connective Tissue Research
Journal of Biomedical Materials Research
Molecular Biology of the Cell

## Research Support

**September 2002- March 2006**

DePuy Orthopedics
CELLECT – The Mixing System for Use in Lumbar Fusion
Role: Principal Investigator
Specific Aims of Project: The goal of the project is to optimize the use of various matrixes for the binding of osteoprogenitors for the purpose of developing graft materials for spinal fusion surgery.
Total Direct Costs 171,000

**November 2001 – October 2002**

DePuy AcroMed Inc.
Bone Product Development Project
Role: Principal Investigator
Specific Aims of Project: To determine the influence of platelet-rich plasma on cells involved in the wound healing/fracture repair cascade.
Total Direct Cost: $96,897

**October 2001-September 2002**

NIH 1 RO3 AG-10931-01
Marrow Bone and Fat Interrelationship; Effects of Age
Role: Principal Investigator
Specific Aims of Project: Test hypothesis that age-related changes in the levels of marrow-associated bone and fat tissue results from changes in the replication and differentiation potential of marrow-derived mesenchymal stem cells.
Total Direct Cost: $50,000

**July 2001 - December 2001**

Senior Faculty Fellowship
Aging Effects on hMSCs
Role: Principal Investigator
Specific Aim of Project: Generate preliminary data to support the submission of a grant to study the influence of

| | |
|---|---|
| | donor age on the ability of human mesenchymal stem cells to differentiate into various types of skeletal and connective tissue.<br>Total Direct Costs: $10,000 |
| **November 2000 – October 2001** | DePuy AcroMed Inc.<br>Role: Principal Investigator<br>Specific Aim of Project: To generate a marrow cell-derived bone product that is superior in in vivo bone-forming characteristics as compared to whole marrow.<br>Role: Principal Investigator<br>Specific Aims of Project: Confidential<br>Total Direct Cost: $143,003 |
| **October 1997 – September 2000** | NIH 1 RO3 AR 45082-01<br>Mechanisms Governing Osteogenesis from Human Mesenchymal Stem Cells<br>Role: Principal Investigator<br>Specific Aims of Project: To identify the mechanisms by which glucocorticoid and interleukin-1 induce the osteogenic differentiation of human mesenchymal stem cells.<br>Total Direct Cost: $149,988 |
| **January 1995 – December 1998** | Osiris Therapeutics;<br>Automitogenic Factors Synthesized by Mesenchymal Stem Cells.<br>Role: Principal Investigator<br>Specific Aims of Project: To identify novel bioactive proteins synthesized by Mesenchymal Stem Cells.<br>Total Direct Costs: $330,000 |
| **October 1996 – September 1998** | Investigator Sponsored Investigational New Drug (IND), Phase I Toxicity/Efficacy Clinical Trial; Funded by Osiris Therapeutics<br>Use of human mesenchymal stem cells to enhance bone marrow re-engraftment after bone marrow transplantation in breast cancer patients.<br>Total Direct Costs: $75,000 |
| **July 1993 -June 1996** | Northeast Ohio Multipurpose Arthritis Center;<br>Distinctive Phenotypic Markers of Human Bone Marrow Mesenchymal Stem Cells.<br>Role: Principal Investigator<br>Specific Aims of Project: To identify and biochemically characterize protein antigens recognized by monoclonal |

antibodies which specifically identify human mesenchymal stem cells
Total Direct Costs: $135,000

**June 1993 - May 1995**

NIH/RO1 AG1133-S1 (Supplemental);
Extracellular Matrix and Aging (Skin).
Role: Co-Principal Investigator
Specific Aims of Project: (1) To determine the number of Mesenchymal Stem Cells in marrow as a function of chronological age in man and rodent; (2) To identify and isolate Mesenchymal Stem cells from human skin specimens.
Total Direct Cost: $108,000

## Postdoctoral Research Associates

1. **Qussay A. Albakri, Ph.D.**, 1996-1997

## Graduate Students

**Daniel Reuben, M.S.**, Masters Student 1992-1994; currently Daniel Reuben, M.D., staff physician, Praxair Cancer Center, Danbury CT.
**Eric Fusillero, M.S.**, Masters Student 1993-1994;
**Kalvin Wiley B.A.**, Masters Student 1993-1994; currently Kalvin Wiley, M.D. private practice physician in internal medicine, Towson, MD.
**Amy Akstens, M.S**, Masters Student 1993-1996; currently a High School Biology Teacher in Parma, OH.
**Richard Rupp, M.S.**, Masters Student 1994-1996.
**Lynn Jedlicka, M.S**., Masters Student 1994-1995; currently Lynn Jedlicka, M.D., resident physician at the MetroHealth Rehabilitation Institute of Ohio.
**Ovidiu Mocanu, M.S.**, Masters Student 1996-1997.
**Xu Rong, M.S.,** Masters Student 1996-1998; currently a Ph.D. student at Stanford University in Biomedical Informatics.
**Michelle Mutryn, B.A.**, Masters Student 1996-1998.
**Kishan Nagodawithana, B.S.**, Masters Student 1996-1999.
**Tina Thomas, M.S.**, Masters Student 1997-1999. Ph.D. student 1998-Present
**Maria-Danielle Mackay**, **B.S.**, Ph.D. Student 1999-Present.
**Vance Holt, B.S.,** Ph.D. Student 2005-Present

## Undergraduate Laboratory Research Students

**Deepak Sudheendra**, 1994-1997
**Harsha S. Reddy**, Summer-1995 Howard Hughes Summer Program in Undergraduate Research; currently, Harsha S. Reddy, M.D. third-year reident in opthamology, Doheny Eye Institute.
**Letitia Nall**, 1995
**Naomi Sandor**, Summer-1996 Howard Hughes Summer Program in Undergraduate Research; currently, Naomi Sandor, D.O., family practioner, Biloxi Regional Medical Center, Biloxi, MS.
**Carl Lawson**, Summer-1996 Howard Hughes Summer Program in Undergraduate Research.

**Amy Grifffith**, Summer-1997 Howard Hughes Summer Program in Undergraduate Research.
**Terry Woodard**, Summer-1997 Howard Hughes Summer Program in Undergraduate Research.
**Janelle Hendry**, Summer-1998 Howard Hughes Summer Program in Undergraduate Research; currently Janelle Henning, recently completed residency in family medicine, Fairview General Hospital, Cleveland, OH.
**Linda Bos**, Summer-1999 Howard Hughes Summer Program in Undergraduate Research.
**Chrishone Evans,** Summer-High School Student, 1999 Howard Hughes Summer Research Program.
**Kellee Gooden,** Summer-2000 Howard Hughes Summer Program in Undergraduate Research and two semesters of undergraduate research; currently Kellee Gooden, M.D., resident, physical medicine and rehabilitation, Scwab Rehabilitation Hospital, University of Chicago Hospitals, Chicago, IL.
**Paul Tesar,** Summer-2000-Present: Howard Hughes Summer Program in Undergraduate Research and two semesters of undergraduate research, currently Ph.D. student, Oxford/National Institutes of Health Scholars in Biomedical Research Scholars Program.
**Abigial Zake**- Summer-2002 Howard Hughes Summer Program in Undergraduate Research.
**Vance Holt** - Summer-2003 Howard Hughes Summer Program in Undergraduate Research; currently, Ph.D. student, Department of Biology, Case Western Reserve University.

## Research Assistants

**Amy Akstens, M.S.** 1992-1996
**Li-Nuo Liang, M.S.** 1996-2004

## University Committees & Service

| | |
|---|---|
| **1995-1997** | Department of Biology Curriculum Enhancement Committee |
| **1993-1997** | Department of Orthopaedics Committee on Equity in Professional Affairs |
| **1996-2003** | Department of Biology Graduate Affairs Committee |
| **1997-1999** | Transitions Program Facilitator. A program designed by the Office of Undergraduate Admissions to assist students in coping with the transition of leaving home for college. |
| **1998-1999** | Search Committee for Director Position, Case Western Reserve Health Sciences Library |
| **1998-2000** | Search Committee for the Position of Chair and Professor in the Department of Biology, Case Western Reserve University |
| **1998-2003** | Minority Affairs Committee of the Faculty Senate |
| **1999** | Michelson Morley Award Committee (University Award) |
| **1999** | Michelson Morley Competition Judge (Biology Department) |
| **1999-2001** | Interim Chair, Minority Affairs Committee of the Faculty Senate |
| **1999-2000** | Diversity Leadership Committee; committee headed by the Provost with a mission to develop objects and priorities for improving diversity at all levels within the University. |
| **2000-Present** | Ireland Cancer Center Stem Cell Facility Advisory Board |
| **2000-2001** | Financial Aid Working Group Committee; appointed to committee by the provost, mission to advise outside consultants in developing plan to optimize financial aid strategy for recruiting undergraduate students. |

| | |
|---|---|
| **2000** | Undergraduate Admissions Special Review Committee; mission to identify minority applicants with the greatest potential for success at CWRU among those whose credentials don't meet standard admissions criteria. |
| **2001-2003** | President's Council on Minority Issues |
| **2001-2003** | Chair, Minority Affairs Committee of the Faculty Senate |
| **2001-2002** | Chair, Graduate Affairs Committee, Department of Biology |
| **2001** | Chair, Search Committee for Molecular Developmental Biologist Faculty, Department of Biology |
| **2001-2002** | Member, Presidential Search Committee for Case Western Reserve University |
| **2001-Present** | Member, Cell and Gene Therapy Quality Assurance Committee, Ireland Cancer Center |
| **2002-2003** | Chair, Search Committee for Vice-Provost of Undergraduate Enrollment |
| **2002-Present** | Member, Deans Cabinet |
| **2002- Present** | Attend, Executive Committee |
| **2002-Present** | Attend, Chair Council |
| **2002-2003** | Chair, Modern Languages Learning Lab/ Multimedia Learning Lab Planning Committee (Freedman Center) |
| **2002-2004** | Member, Research ShowCase Steering Committee |
| **2002-2004** | Chair, Dean's Advisory Committee on Recruitment (DAGOR) |
| **2002-Present** | Chair, Space Planning Meeting |
| **2002-Present** | Chair, W.P. Jones Grant Evaluation Committee for Pretenured Faculty |
| **2002-Present** | Chair, Adelbert/Squires Full Tuition Scholarship Committee |
| **2003-2004** | Member, Search Committee for Provost and University Vice President |
| **2003-2004** | Member,Visions Committee, Department of Biology |
| **2003-2004** | Member, Enrollment Management Strategy Team |
| **2003-2004** | Member, Search Committee for Stem Cell/Tissue Engineering Faculty in Biology |
| **2004-Present** | Chair, Undergraduate Experiential Fellowship Evaluation Committee |
| **2004-2005** | Chair, Search Committee for Tenure Track Faculty in Department of Communication Sciences |
| **Summer 2005** | Member, SAGES and Large Freshman Class Special Needs Committee |
| **2005-2006** | Chair, Search Committee for Chair of Department of Communication Sciences |

## Grant Reviewer

| | |
|---|---|
| **1998** | Special Emphasis Panel, National Institutes of Health, Department of Health and Human Services |

## Undergraduate and Graduate Teaching

**Organismal Biology; Biol 220 (1992-2001)**

In this course I taught a block of seven lectures each spring semester. The subject focus is an introduction to developmental biology. My objective in this course was to provide students with an overview of developmental logics and an introduction to developmental mechanisms during embryonic development. Course enrollment fluctuated between 180 and 200 students.

**Mechanisms of Biological Development; Biol 362/462 (1993-2001, 2003, Summer 2005)**
I taught this three credit hours course each fall semester for several years and now teach it during the summer. Students were primarily seniors and graduate students and the number of students ranges from 25-50. My objective in this course was to develop critical and analytical thinking skills through the study of the mechanisms of biological development. Class time was divided between lecture, Socratic dialog and informal and formal group projects.

**Cell Biology Laboratory; Biol 211 (1992-2001)**
I taught five weeks (one-third of the course) of this two credit hour laboratory course each fall semester. Objectives included developing laboratory skills as well as critical and analytical thinking skills through the planning, implementation, and reporting of a laboratory project to test a hypothesis provided at the beginning of the course. Course consisted of 4 lab sections (16-20 students per section) and one recitation per week.

**Organisms and Ecosystems, Biology 216 (2002 –Present)**
In this course I teach a block of six lectures each spring semester. The subject focus is an introduction to developmental biology. My objective in this course is to provide students with an overview of developmental logics and an introduction to developmental mechanisms during embryonic development. Course enrollment fluctuates between 120-150 students.